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ABSTRACT

This publication is an introduction to personal energy conservation. The first chapter presents a rationale for conserving energy and points out that private citizens control about one third of this country's energy consumption. Chapters two and three show how to save money by saving energy. Chapter two discusses energy conservation methods in the home such as caulking, insulation, temperature settings, and so forth. Chapter three discusses energy conservation measures outside the home such as automobile maintenance practices, landscaping for shade and windscreens, and driving habits. Chapter four discusses future uses of renewable energy sources such as solar, wind, geothermal, etc. and the various proposed technologies associated with these future sources. All the energy conservation methods suggested were included because they were judged cost effective; i.e., enough money would be saved over a reasonable period of time from using them to return the money invested initially. MR)

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SAVING MONEY THROUGH

ENERGY CONSERVATION*

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PREFACE

This book can save you dollars, help extend the availability of limited resources of our country, and help maintain economic stability. These are the sole objectives of the book, and they cannot be obtained without your support and effort.

In the first chapter we attempt to prove to you that there is indeed an energy crisis, and that it can become quite severe if we don't do something about it. We try to show that energy conservation is the first step that needs to be taken, and that conservation can do a great deal. Private citizens control approximately one-third of the total energy consumption. Past studies have shown that savings of 15-30% are realizable without a great deal of effort or sacrificing. Total potential savings are then quite large.

Chapters II and III of the book show you how to save money by saving energy. In Chapter II, energy conservation in the home is discussed. It discusses simple techniques such as caulking, insulation, adjusting thermostats, etc., that can save substantial amounts of energy.

Chapter III discusses energy conservation outside the home. Subjects such as auto tuneups, proper tire inflation levels, landscaping outside the home, trip planning, etc., are covered in this chapter.

Chapter IV discusses the future. We would like to think that renewable source energy such as solar, wind and geothermal can provide us with the desired levels of energy in the future. This chapter

shows that renewable source energy will help; but, that we will have a problem meeting energy needs in the foreseeable future. Various proposed technologies are also discussed.

We sincerely hope you enjoy this book, and that it helps solve our energy problems. We know you can save substantial money by following the simple principles shown and we hope that you do. It is important to note that everything we have presented is cost effective in that you will save enough money to pay off investments in a reasonable amount of time.

We are grateful to the many people who made this book possible. Dr. Faye McQuiston of Oklahoma State University provided technical aid and Ms. Jane Aston also of Oklahoma State University did the illustrating of this manual. The Federal Energy Agency (FEA), Energy Research and Development Administration (ERDA) and many other governmental agencies provided material for the book. Oklahoma Natural Gas, Oklahoma Gas and Electric, and many other utilities also provided information. Many energy producing companies such as Phillips Petroleum, Conoco, and Cities Service also helped. Primary aid, however, was obtained from the Oklahoma Department of Energy.

Finally, we are deeply indebted to the Oklahoma Regents of Higher Education, who funded this research and subsequent teaching. The funding was administered through Mr. Jerry Hargis of the Regents' office through program IMPACT of the Higher Education Act. Without Mr. Hargis and the State Regents, this program could not have been performed.

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CHAPTER I

ENERGY AWARENESS

The Energy Crisis. Embargoes. Conservation. Environmental Impacts. National Energy Policies. FEA. Smaller Cars. MPG. Double-nickle Speed Limits. 68° in Winter. 78° in Summer. Insulation.

These are topics all of us have heard or read about many times during the past 3 to 4 years. We read reports on energy ranging from warnings of impending doom to allegations that the whole thing is a hoax with the government and the oil companies in cahoots. Sometimes it appears that all the talk is reaching the point to where it's like water on a duck's back--it just doesn't soak in. Or, since there appears to be plenty of gas at the pumps when we are supposedly running out, no one really believes it. So everybody has got their ears on, tuned to channel one-nine to pick up the smokey report so that they don't have to feed the bears when they break that old double-nickle. Ten-four.

But how many of us have ever sat down and really examined the facts to determine for ourselves if there actually is an energy shortage? That is what we will attempt to do, in summary fashion, in the next few paragraphs. If you agree that there is a shortage, what can you as an individual do to relieve it? One answer is to conserve, and we hope to show you how in the following chapters. If you do not agree that there is an energy problem worthy of concern, there is still a good reason for you to conserve; energy costs are going to increase. Saving energy will fatten your wallet, and that is incentive for all of us.

Some U. S. Statistics

- The U. S. has 6% of the world population, but we consume 33% of the world's energy.
- Our energy demand doubled between 1950 and 1970 reaching an annual consumption rate of 67.4 quadrillion BTUs. (i.e., 67,400,000,000,000,000 or 67.4 x 10^{15} BTUs.) It is expected to double again by 1985.
- We now depend on petroleum products (oil and gas) for 3/4 of our energy needs, while they represent only 7% of our proved economically recoverable reserves, as indicated in Figures 1 and 2. This means that we now depend on our least abundant reserves for the majority of our needs.

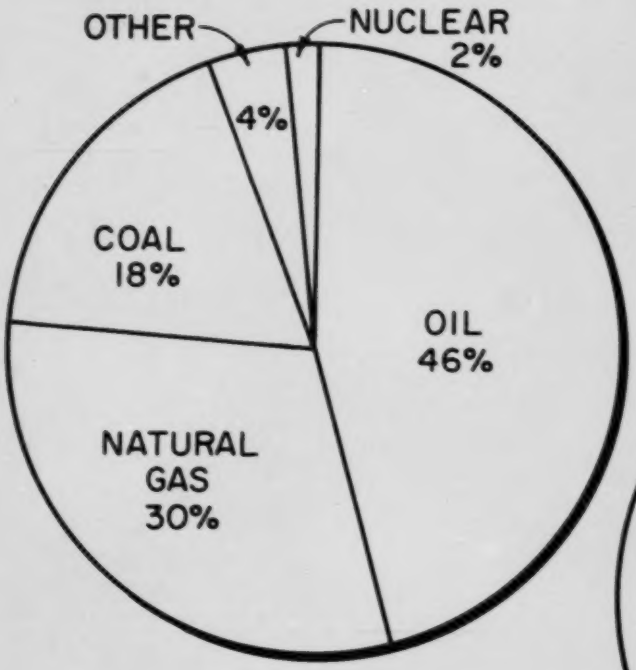


Figure 1. 1974 U. S. Energy Sources

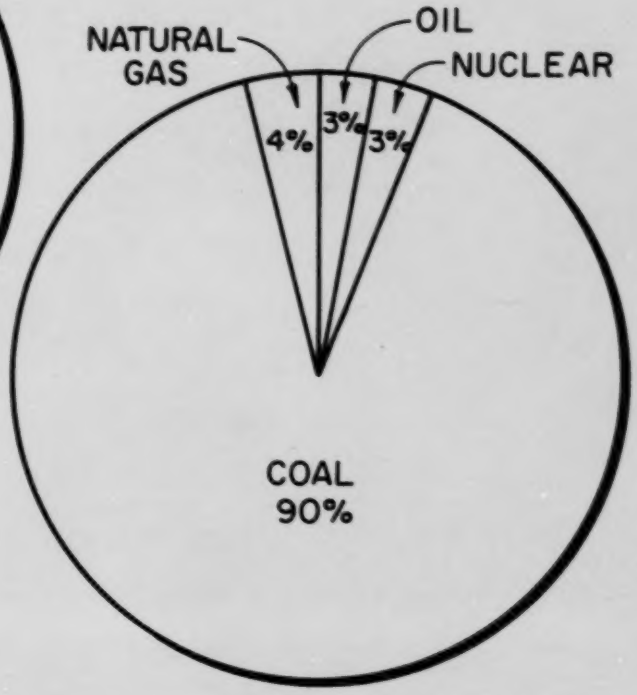


Figure 2. U. S. Proved Reserves Economically Recoverable With Existing Technology

• While the Arab oil embargo of 1973/74 was at least partially responsible for the reduction of U. S. energy consumption by 2.2% from 1973 to 1974, it did not decrease our dependence on imported oil. In 1970 we imported 23% of our petroleum needs; in 1975 it increased to 37%. Recently it has been as high as 45%.

• We now import 15% to 17% of our total energy consumption.

• In 1970 our domestic oil production peaked at 9.6 million barrels per day and has declined ever since; domestic gas production peaked in 1974.

• By the year 2000 our population will increase 23%, GNP will increase by 233%, and without conservation our energy demand will increase by 250% to 174 quadrillion BTUs. If new sources are not developed and existing sources are not utilized, this will lead to a gap of 148 quads by 2000.

These statistics indicate that there is indeed an energy gap. We are demanding more and more energy and producing less and less. At present the need is being met by increasing imports. However, if this trend continues until we depend on imports for most of our needs, it will be like playing Russian roulette with embargoes as bullets.

Reasons For The Energy Gap

A good question at this point might be "How did we get into a mess like this?" Well, we believe there are several reasons.

(1) A growing demand for more energy, especially petroleum.

(2) Inexpensive imported oil prior to the embargo

which was a disincentive to the production of domestic oil.

(3) Regulated gas prices which had the effect of reducing exploration for new supplies.

(4) Environmental drawbacks of other energy sources, especially coal and nuclear power.

(5) Waste.

Massive amounts of research are being conducted at the present in an effort to discover new energy sources to help our country overcome its energy shortages, but all these efforts require time. It is expected that we will not receive a substantial amount of our energy from sources other than petroleum for 10 to 15 years. In the meantime, our job as citizens is to conserve what we now have and to save what we now waste. This will buy the time we need to develop new, safe, and environmentally acceptable energy sources. A quote from the final report of the Oklahoma Energy Advisory Council - Energy In Oklahoma illustrates this.

"Conserving energy - by reducing its consumption and making more efficient use of the energy that is consumed - is the only short-term answer to the energy crisis, and must be a major part of the long-term solution as well."

And don't forget - whenever you save energy, you save money.

Private Citizens

Before going on it is important to know just how much energy is actually used by individuals. A look at Figures 3A, 3B, and 3C shows

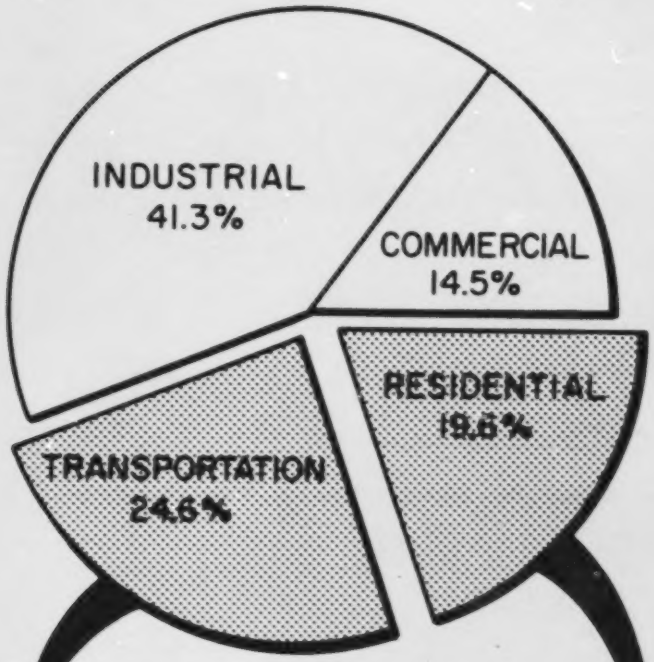


Figure 3A. Total U. S. Energy Consumption by Sector

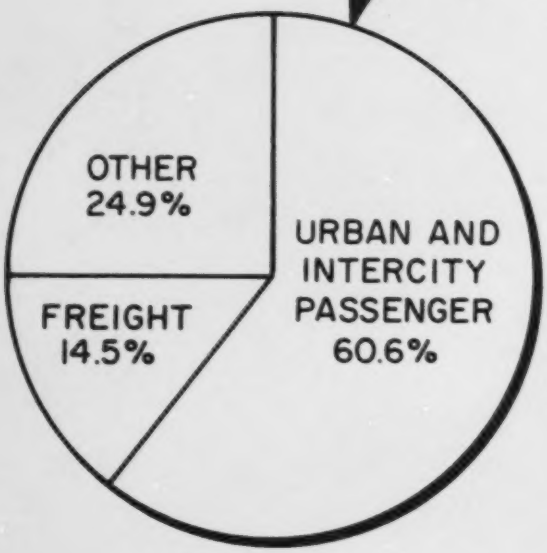


Figure 3B. Total U. S. Transportation Energy Consumption

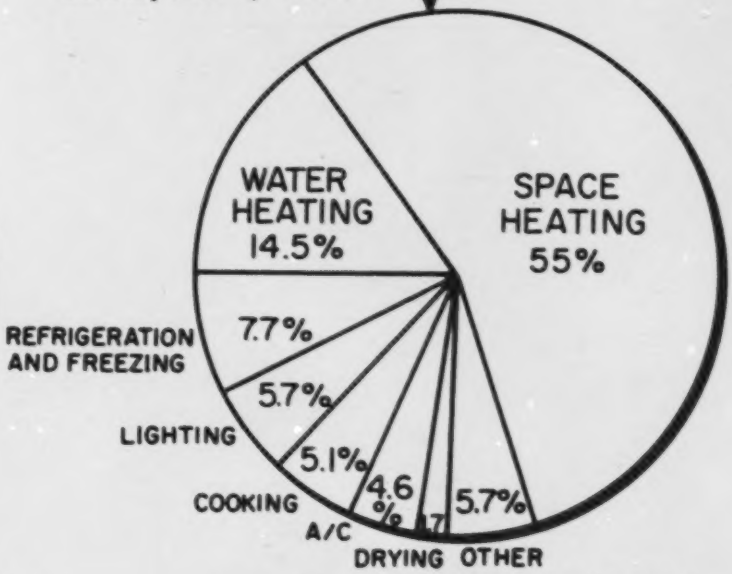


Figure 3C. Total U. S. Residential Energy Consumption

that the private sector consumes over 1/3 of the total energy requirements of the U. S.[1] So with a little effort and a money-saving incentive, we can produce substantial savings for the country, not to mention ourselves.

In the next two chapters we present specific energy conserving techniques. Everything covered has been proven to save energy and money. In fact, some of you will be able to save up to $500 per year through a conscientious study and application of the techniques presented, in and around your home.

[1] 19.6% Residential + [24.6% Transportation X 60.6% Urban and Intercity Passenger] = 34.5% controlled by the private sector.

CHAPTER II

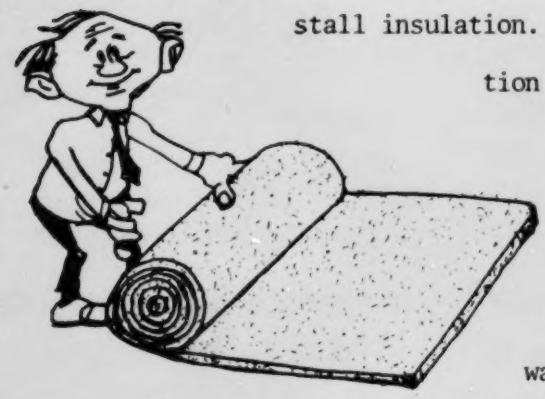
ENERGY CONSERVATION IN THE HOME

This chapter is devoted entirely to energy tips which can be applied in the home. Most of the techniques are easy to do and only a few require any investment.

How should you go about saving money on your home energy costs? Since over half of your energy budget is devoted to heating and cooling your home, this appears to be a logical place to start. Just a small percentage savings in this area can produce a substantial savings[2] in your total energy bill.

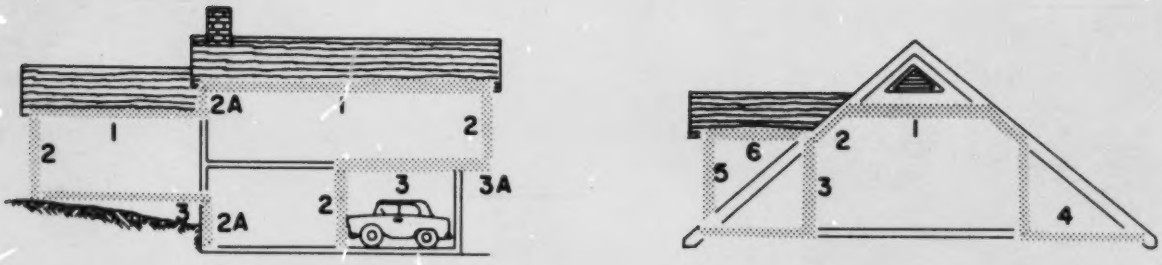
Insulation

If you presently have no insulation in your home, or very little, then the number one way to save on heating and cooling bills is to install insulation. The number one place to install insulation is in your attic floor where some 40% of the heat loss in your home can occur. (With 6 inches of attic insulation roof heat loss drops to approximately 10%.) Other good places to insulate are exterior walls and floors over unheated areas. Figure 4 shows the areas to install insulation. Depending on the amount you



[2]Actual dollar savings were omitted from this and subsequent chapters for the sake of brevity. However, Appendix A contains estimates of savings in summary form for many of the suggestions mentioned in Chapters 2 and 3. These are rough estimates since they are based largely on data for the "average American family." Your own savings will be either higher or lower depending on your personal circumstances. Appendix B contains a checklist of suggestions contained in this manual.

now have, insulation can save from 20% to 30% of your heating and/or air-conditioning bill.



1. Ceilings with cold spaces above
2. Exterior walls
3. Floors over cold spaces

1. Between "collar beams"
2. Between sloping rafters
3. Between the studs of "knee walls"
4. Between the joists of the floor outside the living space
5. Dormer walls
6. Dormer ceilings

Figure 4. Where To Insulate (Source: How To Save Money By Insulating Your Home, National Mineral Wool Insulation Association, Inc., Summit, N. J.)

Insulation comes in various materials, with mineral wool (fiber glass or rock wool) and cellulose fiber being the most common. It is available in blankets, batts, or loose for pouring or blowing. Batts and blankets are sometimes used during initial construction where they are suitable for practically all insulated areas. Loose fill is good for filling irregular spaces and when adding to the walls of a completed house.

The most important thing to know about insulation is the R-value. The R-value, which is printed on all kinds of insulation, is a standard

measure of the insulation's ability to resist the flow of heat--either winter heat loss or summer heat gain. The higher the R-value the greater the insulation property. Different brands may be different thicknesses, but if they have the same R-value either will work equally well. The following is the recommended and minimum recommended R-values for various areas in most homes.

Area	Recommended R-value	Recommended Minimum R-value
Ceiling/Attic Floor	26 to 30	19
Outside Walls	11 to 13	11
Floors over unheated spaces	9 to 11	9

Table 1 compares the various thicknesses required to obtain a certain R-value using different insulating materials.

Table 1. Comparison of R-value Vs. Insulation Types

R-value	Type of Insulation				
	Batts Or Blankets		Loose Fill (Poured-in)		
	Fiberglass	Rock Wool	Fiberglass	Rock Wool	Cellulose Fiber
R-3	1"	7/8"	1 3/8"	1"	7/8"
R-9	3"	2 1/2"	4"	3 1/4"	2 1/2"
R-11	3 1/2"-4"	3"	5"	4"	3"
R-19	6"-6 1/2"	5 1/4"	8"-9"	6"-7"	5"
R-22	6 1/2"	6"	10"	7"-8"	6"
R-30	9 1/2"-10 1/2*	9"*	13"-14"	10"-11"	8"
R-38	12"-13"*	10 1/2"*	17"-18"	13"-14"	10"-11"

* Two batts or blankets required

Source: "Save real money cooling and heating your home," Changing Times - The Kiplinger Magazine, July, 1976.

Another important factor to consider when installing insulation (especially if you add it yourself) concerns the vapor barrier. The vapor barrier is made of a material which will not absorb moisture or allow moisture to pass through it. Since moisture will hamper the effectiveness of insulation, it is important that the side with the vapor barrier face the living area of the house. If you install insulation in addition to some that already exists, either use insulation without a vapor barrier (i.e. unfaced or loosefill) or be sure to slash the vapor barrier freely before you install it. This prevents water vapor from becoming trapped between the two layers of insulation. Be sure to insulate under attic walkways and around chimney openings and pipes passing through the attic floor. And, don't forget the back of the attic door or scuttle panel.

If you live in a mobile home there isn't much you can do to insulate your ceiling or walls; but, you can be sure to install skirting around it. Insulation behind the skirting will help, but the skirting is the most important aspect in preventing heat loss.

Caulking and Weatherstripping

One of your next major areas of concern should be air leaks around your home. These leaks account for 10% to 30% of the heat loss in an average home. In fact, if you already have good attic insulation then the majority of your home's heat loss occurs through cracks in the walls and around the windows. Therefore, their elimination can save you up to 10% of your total energy bill and possibly much more.

Caulking and weatherstripping is a simple do-it-yourself job and can provide substantial savings. Here are a few helpful hints.

(1) Caulk all cracks between outside door frames and window frames and the siding or masonry.

(2) Check all window panes to see if they are loose. If so, re-putty them with glazing compound.

(3) If you leave your window-mounted air conditioner in place all year, be sure that air leaks are plugged with caulking or weatherstripping.

(4) Install weatherstripping along the edges of outside doors and windows and along movable points. Metal weatherstripping is typically best because it will last longer than felt or rubber.

Storm Doors and Windows

Approximately 20% to 30% of a home's heat loss occurs through the windows. Again, this figure can be higher depending on the amount of insulation you presently have. The installation of storm windows can reduce that loss by 50% thereby saving you 10% to 15% of your home heating bill. However, the price of these windows ($20 to $30) may be prohibitive. If so, plastic sheets tacked to the window frames will produce a similar effect[3] at a much lower cost (approximately $10). Thermopane glass, which is two layers of glass separated by an air space, is also being used in may homes to cut heat losses.

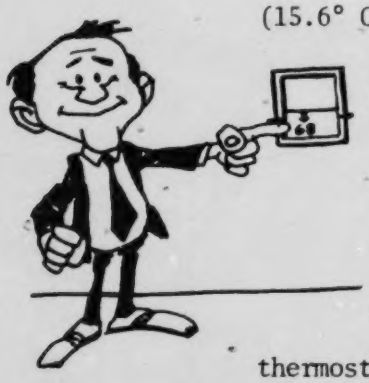
[3]The thickness of the glass (or plastic) has no major effect on the insulating property. What does insulate is the layor of still air created between the window and the screen.

Storm doors also provide some protection from heat loss, however their cost (approximately $75) may be prohibitive in light of savings except in the northernmost states.

Winter Energy-Saving Tips

Before delineating the tips, let's consider the principles of heat loss/gain. It is basically a function of the difference in temperature between the interior and exterior of your home; the greater the temperature difference the greater the heat loss or gain. Several methods of reducing heat loss/gain have already been discussed, i.e., insulation, storm windows and caulking. Another effective method of reducing heat losses and gains is to reduce the interior-exterior temperature difference by adjusting the thermostat accordingly. This and other cold weather tips are given below:

(1) Set your thermostat on 68° F. (20° C.) during the day and 60° F. (15.6° C.) at night. Some advocate even lower nighttime temperatures, but if the thermostat is lowered too much your system will have to run longer than usual the next morning in order to bring the temperature back up to normal which could offset savings gained by the overnight low. A good rule of thumb is to not lower the thermostat overnight more than 10% to 12% of the daytime setting. Studies have shown that a nighttime reduction of 8° from 72° F. to 64° F. can result in a 10%-14% savings in heating bills. However, if you are going away for a weekend or vacation you can lower it to about 55° F. (12.8° C.). Your nighttime setting is also appropriate for the day if no one will be home. But, it



is recommended that you not turn the thermostat up higher than normal when you return. It will not cause the room to heat up faster; it will just cause the heating system to run longer until the room reaches the higher temperature.

(2) In order for nighttime reductions to save a sufficient amount of money they must be done consistently. A good investment is a clock thermostat (approximately $70-$100) which would lower the thermostat shortly before bedtime and raise it again shortly before you awake in the morning. These can be easily added to your existing system.

(3) Higher relative humidity helps your body stay warmer in cooler temperatures by retarding moisture evaporation. If you do not own a humidifier a pan of water strategically located near a heating outlet, house plants or an indoor clothes line will all provide such moisture.

(4) Wear warm clothing. Wool is the warmest with wool blends the next best. Avoid polyester knits. Several layers of clothing will keep you comfortable in cooler temperatures and flannel PJ's will probably keep you warmer than your electric blanket.

(5) Have your furnace "tuned-up" at least once a year, preferably before the heating season. Have the flame adjustment for the pilot light and the main burner set by a serviceman to insure efficient combustion. Also have it cleaned; accumulated soot acts as insulation and increases fuel consumption. A good tune-up/clean-up can up to save 10% of your fuel bill.

(6) Check your filter every month and clean or replace it as necessary. A dirty filter will restrict air flow causing poor distribution and increase blower time.

(7) Seal all air leaks at heating duct joints with duct tape, and insulate all duct work in unheated areas. (R-8 or 2" is a minimum.) This helps keep the heat in the ducts until it reaches the outlet registers.

(8) Keep radiator surfaces and heat registers clean. Dust acts as an insulator and reduces heat transfer. Don't obstruct registers with furniture or other objects. Aluminum foil placed behind radiators will reflect the heat back into the room.

(9) Close off unused rooms, shut off the registers or outlets if possible, and insulate the room as much as possible. A rolled-up towel across the door crack will eliminate the cold draft.

(10) Use portable heaters to heat small areas only; they are not as efficient as central heating. Electric portable heaters are particularly inefficient sources of heat.

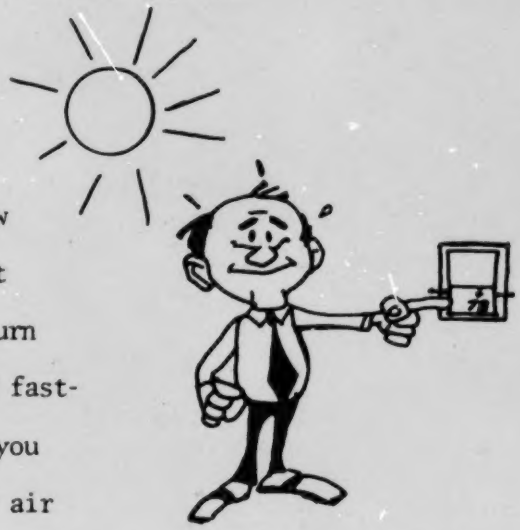
(11) Keep your curtains or shades open in sunny south and west windows during the day, unless it is very windy. The sun's radiant heat will help warm the room, but the insulating effect of another layer of still air resulting from closed drapes is more important when it is windy. Close all curtains at night. Insulated or lined drapes can reduce heat loss by as

much as 16%. Don't allow air from floor registers to blow behind curtains since this disturbs the calm layer of air.

(12) Keep attic vents open in winter if you have good insulation. This will prevent excess moisture from building up and hindering the effectiveness of the insulation.

Summer Energy-Saving Tips

The best way to save energy/money is the summer is again to reduce the temperature difference between the inside and outside.



(1) Set your thermostat on 78° F. (25.6° C.) during the summer. If you plan to be gone all day, you can raise it a few more degrees; but again, do not lower it past 78° when you return in hopes that it will cool off faster because it will not. When you leave on a vacation, shut your air conditioner off completely. In general, each degree setting above 70° F. will save you 4% on your energy bill.

(2) Your air conditioner is designed to not only cool, but to remove moisture as well. Lower humidity will allow you to tolerate higher temperatures. Don't put additional strain on your unit by doing moisture-producing jobs like the laundry or washing dishes during the heat of the day.

(3) On really hot days run the air conditioner fan on high speed. On humid days run it on low which provides less cooling but more

moisture removal. On cooler days shut off altogether and simply open your windows for cross-ventilation or use fans. Be careful of this on humid or rainy days, however, since excessive moisture may enter the house and cause the cooling system to work harder to remove it.

(4) Wear cooler clothing. Lightweight fabrics such as cotton and light colors are the coolest.

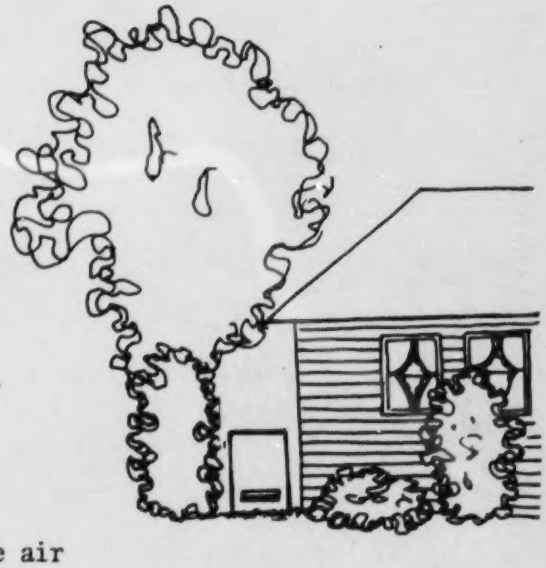
(5) Check the filter once per month. Clean or replace when necessary. A dirty filter reduces air flow and causes the fan to run longer.

(6) Keep lights low or off during the hot part of the day since they produce heat and add to the air conditioning load. The same goes for heat-producing appliances such as irons, ovens, dryers, and kitchen appliances. Cook during early morning and late evening hours.

(7) Turn off the furnace pilot light during the summer months.

(8) An attic fan can reduce the downward flow of heat in your attic where temperatures can be as high as 140° F. A thermostatically controlled unit is even better because it will turn the fan on when the temperature reaches a pre-determined level and then off when the temperature drops to a certain point. A well insulated attic with good ventilation probably does not need a fan.

(9) Cooling ducts should be taped to plug air leaks and insulated as well. This keeps more air in the ducts and consequently into the living area of your home.



(10) Shade your air conditioning unit as much as possible. This can be done with trees, shrubs, awnings, or by placing it on the north side of your home. The cooler the outside air in contact with the unit's condenser, the more heat the air is able to absorb from the condenser. Consequently, the unit can more efficiently remove heat from your home. Also, be sure that the air flow to the unit is not blocked by shrubs, grass, grass clippings, leaves or any other objects. It is also a good idea to clean the condenser coil each year before the cooling season.

(11) On hot days draw curtains or shades in sunny windows. Light colored drapes reflect the sun's radiant heat and keep it from entering your home. Special drapery lining designed to reflect sunlight works even better.

(12) Open doors and windows no more than necessary, especially during the hottest part of the day.

Water Heating

Heating water is the second largest use of energy in your home. Therefore care should be taken to conserve what hot water you use and to prevent wasting it. Some suggestions are:

(1) Repair all hot water leaks or drips ASAP (as soon as possible). One leaky hot water faucet can waste from 2500-5000 gallons of heated water per year, and that is truly "money down the drain."

(2) Make sure the hot water heater and piping are sufficiently insulated. Great amounts of heat can be lost from uninsulated piping.[4] The following table shows how insulating pipes can cut losses for electric heaters.

Table 2. Savings From Insulation of Pipes

Pipe Length	Pipe Diameter	Insulation	Savings/Yr.
25 ft.	1 in.	1 in.	700 KWH
25 ft.	3/4 in.	1 in.	580 KWH
25 ft.	1/2 in.	1 in.	400 KWH

One inch of insulation around your hot water tank can save up to 190 KWH per year while 4 inches can save approximately 380 KWH annually. If you have a gas water heater your percent-savings will be approximately the same, but the actual dollar amount will be less since gas is more efficient.

(3) Again, heat losses are closely related to the difference in temperature. Consequently, heat losses will be less if the

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[4]The same principle of heat loss due to the difference in temperature applies here. It also is a function of the pipe diameter and length.

temperature of the water is kept closer to the surrounding temperature. A recommended temperature is 110° F. (43.3° C.) if the hot water is to be used only for bathroom purposes and 140° F. (60° C.) if you own a dishwasher. If you are leaving for several days the temperature can be lowered 10°-20° (more if it is kept at 140° F.). It is estimated that water heating costs increase 3% for every 10° F. increase above 140° F.

(4) The "average family" uses 26 gallons of hot water per day per member. Some families will use as much as 68 gallons per member per day. A good goal would be to attempt to cut each member's use by 10 gallons per day.

(5) Don't allow hot water to run while you wash your hands or face, shave, wash your hair, or rinse dishes.

(6) Periodically drain off the bottom water in your hot water tank. This will remove the sediment which accumulates and interferes with heat transfer to the water.

(7) Take showers instead of baths. They generally require 1/2 the water a full tub bath does, unless you like to linger.

(8) Consider installing flow restricters (a device that limits the amount of water flow) on all outlets, especially the shower head. These can be purchased at most hardware stores and will reduce the normal 6-10 gallons per minute flow to 4 gallons per minute.

Energy Use In The Kitchen

The third largest component of your energy bill is the requirements of cooking, refrigeration, and freezing, (i.e., in the kitchen). Almost 13% of household energy consumption results from these areas, and there is much that can be done to help cut this usage and consequently save money.

First, let's talk about cooking. It is not our intention to tell you how to cook, because we do not claim to be experts by any means. What we will attempt, however, is to present some basic tips which, if followed, can save energy and money. In most cases they also save time! Chances are you are probably already doing many of these things, but if not, our mentioning them here may help.

(1) During summer do as much cooking as possible during the cooler part of the day, i.e., early morning and late evening. This reduces the cooling system's load. Also, be sure to use the kitchen exhaust fan to draw the heat out. On extra hot days, plan a no-cook meal or cook outdoors.

(2) Plan to cook several dishes at one time or in succession in the oven. Baked goods can be frozen for later use. This procedure makes maximum use of the oven's heat-retaining capabilities. Immediately after cooking is also the best time to use the self-cleaning feature of your oven.

(3) The less the oven or stove is on, obviously, the less energy it uses. Some speed-up suggestions are:

(a) Pressure cookers: They normally require only 1/3 the time ordinary cooking requires.

(b) Covers on pots and pans: They work on the same principle by keeping heat in the pans and therefore reducing cooking time.

(c) Defrosting frozen foods: A roast will cook in 1/3 less time if it has been thawed. There is no need to spend energy thawing food when a little previous planning will avoid it.

(d) Using proper amounts of water: More water than necessary requires more boiling time. Also start with hot tap water; part of the heating will already be done and by a more efficient process.

(e) Careful preheating: When preheating is necessary, as when cooking less than an hour or timed cooking, don't preheat longer than 10 minutes or after the preheat light goes out.

(f) Cooking on stored heat: Stove eyes and especially ovens retain heat for some time after they have been cut off. Take advantage of this.

(4) Avoid opening the oven door and peeking in to check on the roast or cake. Each peek allows 20% of the oven heat to escape and lowers the temperature from 25° to 50°.

(5) Keep the heat reflector below the stove eye clean. Dirt will insulate and reduce the upward transfer of heat.

(6) Use the proper utensils and the correct size. Flat-bottom pans will gather the most heat. An undersized pan will waste much of the stove cap's heat. On gas ranges, make sure the flame does not extend beyond the sides of the utensil. Ceramic, glass, and stainless steel dishes retain heat better than other materials; this allows lower oven temperatures.

(7) Use small single-purpose appliances instead of the range whenever possible. Toaster ovens, popcorn poppers, electric skillets, electric coffeepots, and slow cookers all use less energy for their specific purpose than does the range.

(8) Make sure the pilot light is properly adjusted, because it accounts for 1/3 of your range's energy requirements.

(9) Do not use the oven as a space heater. A portable heater is much more efficient for this purpose.

(10) Microwave ovens are designed to save energy by making efficient use of heat and cooking food much faster. They don't heat up the kitchen either.

Clean-ups are a pain, and chances are you have a dishwasher (either manual or mechanical) to help you out. In either case there are a couple of things you can do here which will save energy.

(1) If you wash dishes by hand, don't let the hot water run the entire time. Rinsing with a sprayer attachment will use less hot water, rinsing in warm even less, and rinsing in cold water uses none at all.

(2) The best way to save when using the dishwasher is to cut down on the number of times it is used. Wash dishes only once per

day, preferably in the evening or when you have accumulated a full load. Don't overload.

(3) Scraping dishes before washing reduces the chances of having to wash them again because they did not come clean the first time. Keep the screen, drains, and filters clean also.

(4) Turn the dishwasher off after the final rinse and let the dishes air dry. This not only saves the energy required to heat the drying air, but it also adds humidity to your house. It is best to do this at night.

Now let's consider refrigerators and freezers. Basically everything that can be said for one can be said for the other as well.

(1) Manual defrost refrigerators and freezers use up to 50% less energy than frost-free models. However, they must be defrosted frequently (before 1/4 inch of frost accumulates) in order to remain more efficient. Ice acts as an insulator and reduces cooling power. Some frostless models now have a switch to turn off the defrost heater[5] whenever the humidity is low resulting in an operating savings of approximately 16%.

(2) Make sure the seal around the door does not permit air leakage. A good check is to close the door on a dollar bill; if the bill will slip out easily with no drag, the seal is inadequate and should be replaced.

(3) The best temperature to maintain is 37° to 40° F. (2.8° to 4.4° C.) in the refrigerator and 0° F. (-17.8° C.) in the

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[5]Frost is caused by moisture which condenses and then freezes. Frost-free models contain a heater which runs (and adds to operating costs) helping to evaporate the moisture.

freezer. This provides adequate cooling and prevents large heat gains. If you leave on vacation you can turn the temperature up a few degrees.

(4) Always cover food before placing it in the refrigerator. This helps prevent frost-forming evaporation and keeps the food fresher.

(5) Keep your refrigerator and freezer full. Air is harder to keep cool than food and it is lost quicker when the door is opened. Open the door as little as possible, and don't buy a unit larger than you need. When loading the freezer don't load too much at one time since this causes the temperature to rise. A rule-of-thumb is to load about 2 lbs. per cubic foot per 24 hours.

(6) Keep the condenser[6] of your refrigerator and freezer clean to allow good air circulation. (It can be cleaned with a vacuum cleaner.) Don't allow it to be pushed back into an area where air cannot freely circulate about the condenser.

Lighting Your Home

The energy required to illuminate your home represents 5.7% of your total energy bill. While it is relatively inexpensive, there is no reason for waste. Here are some facts and tips to help you control your use of lighting.

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[6]It works on the same principle as an air-conditioner.

(1) The wattage a bulb requires measures only the amount of energy needed to light the bulb. The amount of light it gives off is measured in lumens and is not related directly to the wattage. In fact, larger watt bulbs are more efficient than smaller watt bulbs because they provide more lumens per watt. The light given off by

one 100 watt bulb = two 60 watt bulbs = six 25 watt bulbs.

Therefore, it is to your advantage to use a single higher watt bulb in place of several lower watt bulbs when possible.

(2) However, if a single bulb provides more than the desired light, experiment with lower wattages. Places like closets, halls, and outside porches could probably do with less light and still get by. Don't sacrifice safety though.

(3) Long life incandescent bulbs are less efficient than regular bulbs. Limit their use to hard-to-reach areas.

(4) Use fluorescent lighting whenever possible in suitable areas, e.g., bathroom, kitchen, basement, study desk, etc. It is more efficient than incandescent lighting[7] (i.e., more lumens per watt). One 40 watt fluorescent bulb gives off more light than three 60 watt incandescent bulbs. They also produce less heat than incandescent bulbs.

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[7]Because of their construction, fluorescent lights do require a certain amount of power to start them. Because of this and the fact that their life cycle depends on the number and length of on-cycles, fluorescent lights should not be turned off if they will be turned on again in less than 20 minutes. Also the economical break-even point on operation time is 3 hours, i.e., the light should be on at least three hours to be economical.

(5) There is no great "power surge" when you turn on an incandescent light, so always turn them off whenever you leave a room even if you plan to return shortly.

(6) Consider solid-state dimmer switches. They allow you to control the amount of light you need for a particular occasion and, therefore, allow more efficient use of light.

(7) Less lighting is required for light-colored rooms and furniture. Dust or dirt on lamps and light fixtures absorb light and add to the lighting requirements of a room.

(8) Use outdoor lights only when essential for safety. One 100 watt bulb left on every night uses 350 KWH per year. Also, consider a photo-electric cell to turn the lights on at dusk and off at dawn (in case you forget).

(9) Last and the most simple, turn off all lights when they are not needed.

Energy Uses In The Laundry

The big users of energy in your laundry are (1) the hot water required for your washer (85% of washer energy), and (2) heating the air for your dryer. The obvious remedy would be to wash all your clothes in the creek and hang them up to dry on a tree limb. But since that probably isn't what you have in mind, there are a few suggestions you might follow (if you are not already) to cut down on energy usage while washing and drying clothes.

Let's start with the washer.

(1) Do as much wash as possible in warm or cold water. It has been estimated that switching entirely to cold washes can save you 4% of your electric or gas bill. However, cold water washes may require more detergent, softer water, pre-treatment of spots, and longer cycles.

(2) Be sure to wash full, not half-loads. Don't overload though, since this will decrease the cleaning ability and may necessitate a rewash. It is a good idea to set aside a certain day each week for washing so that full loads will have accumulated by that day.

(3) Be sure to sort and wash clothes according to color, dirt, and fabric and adjust cycle time accordingly. A longer wash than is necessary obviously wastes energy and time.

Now, you may not want to dry them on a tree limb, but an outdoor clothes line (or indoor line) is an obvious way to save some energy. In fact, if you hang them on a line to dry just three months out of the year you can save approximately 250 KWH. However, if you cannot hang them out, here are some hints for using the dryer more efficiently.

(1) Remove clothes from the dryer promptly--as soon as, if not slightly before, they are dry. Overdrying not only wastes energy, it also causes clothes, especially permanent press, to wrinkle badly and to become stiffer.

(2) Make sure the seal around the door does not allow hot air to escape.

(3) Dry in consecutive loads so that energy is not used each time heating up the metal parts of the dryer.

(4) Sort according to drying needs to take advantage of shorter drying cycles.

(5) Dry full, but not overloaded, loads.

(6) Keep the lint screen clean. A lint-clogged screen will reduce air flow and increase drying time.

(7) Make sure your dryer is vented according to the manufacturer's specifications.

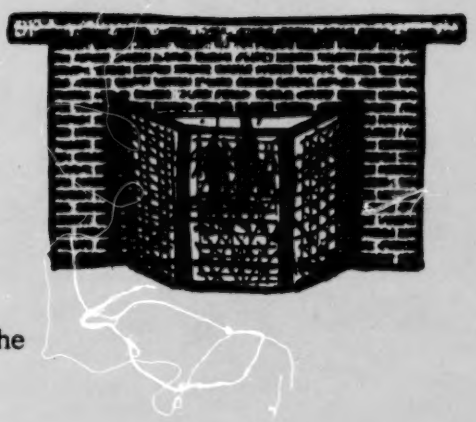
Fireplaces

Fireplaces are not very efficient room heaters since only 10% of the heat they produce enters the room and the rest goes up the chimney; but they sure make a room cozy and are nice to sit and watch. Chances are if you own one you will use it at some time, so when you do, keep the following tips in mind.

(1) Close the doors to all other rooms adjacent to the room with the fireplace. This may help keep the warm air from these rooms from being drawn up the chimney. Lowering the thermostat in these rooms (if there is one) can also help reduce their heat loss. A roaring fire can actually draw more warm air up the chimney than it gives off.

(2) Glass firescreens provide the best protection against nighttime heat losses. They also allow radiant heat to pass through when closed and the fire is going.

(3) Be sure the damper is closed when the fire is out, or when the fireplace is not in use. This prevents the loss of heated air up the chimney. Also close the screen.



Miscellaneous: TV's, Radios, and Appliances

The amount of energy used by your appliances depends on two things: (1) the wattage of the appliance, and (2) the amount of time the appliance is used. To determine the number of Kilowatt-hours(KWH) your appliances consume in a year, use the following formula.

$$\text{KWH per year} = \frac{(\text{Appliance Wattage}) \times (\text{Estimate Hours Used Per Year})}{1000}$$

Tables 3, 4, and 5 show the estimated annual KWH used by various appliances in the "average household." Your actual consumption may be more or less, depending on the amount of time your appliances are used. This knowledge will help you determine which appliances are the most energy-demanding and consequently, which one(s) to cut back on in usage. A good rule-of-thumb is to concern yourself only with appliances that consume more than 20 KWH per year.

The following is a list of hints for the use of miscellaneous appliances.

(1) If possible use electrical appliances during non-peak hours.[8]

[8]Power generating plants depend on low efficiency generating units to meet the extra needs during peak demand periods. If a more continuous demand is maintained, they will not require these units and therefore use less energy in bringing you electricity.

During the summer avoid 1 p.m. to 5 p.m.; during the winter avoid 5 p.m. to 8 p.m.

(2) Your iron is a high energy user. Try to iron in batches so that you can take advantage of stored heat. Removing clothes from the dryer promptly will result in less wrinkling.

(3) Smaller kitchen appliances are much more efficient for their purpose than the oven. For example, the toaster uses only 1/3 the energy the oven does to toast bread.

(4) Vacuum cleaners are more efficient when the bag is clean because the suction is greater. Vacuum only once per week.

(5) If you don't really need your spare refrigerator, unplug it; but be sure to place a lock on the door to prevent entry by children.

(6) Solid state TVs require 50% less energy than tube-types. Instant-on TVs require more energy than ordinary ones because the set is actually on all the time. The use of an exterior on-off switch (or unplugging) could save 6% of the operating cost. Always be sure to turn off the TV or radio when no one is watching or listening.

(7) Close doors quickly. Children should be taught this especially since they are in and out frequently.

(8) Reading your gas and/or electric meter regularly at the end of each billing period will help you compare your usage and see your reductions. In this way you will be better able to manage your energy use.

Table 3: Electric Consumption of Major Appliances

	Average Wattage	Estimated KWH Used Yearly
Air Conditioner, Room	1565	1390
Clothes Dryer	4850	1000
Dishwasher	1200	350
Freezer		
15 cu. ft.	340	1200
15 cu. ft., frostless	440	1760
Radio	70	85
Radio-Phonograph	110	110
Refrigerator		
12 cu. ft.	240	730
12 cu. ft., frostless	320	1230
14 cu. ft.	325	1130
14 cu. ft., frostless	615	1830
17 cu. ft.	400	1250
17 cu. ft., frostless	700	2000
Television		
Color	330	500
B & W	235	360
Washing Machine		
Automatic	510	100
Non-automatic	290	75
Water Heater		
Standard	2500	4200
Quick Recovery	4500	4800

Table 4: Electric Consumption of Kitchen Appliances

	Average Wattage	Estimated KWH Used Yearly
Blender	390	15
Broiler	1450	100
Can opener	60	1
Coffee maker	900	105
Cooker - eggs	500	14
Cooker - casserole	350	50
Cooker - pressure	1300	50
Deep fat fryer	1050	65
Disposal	445	30
Frying pan	1200	186
Grill (sandwich)	1150	33
Hot plate	1250	90
Knife	92	8
Microwave oven	1450	190
Mixer	130	13
Range - with oven	12200	1175
- with self-cleaning oven	12200	1205
Roaster	1350	205
Tea kettle	1200	60
Toaster	1150	40
Toaster oven	1200	75
Trash Compactor	400	50
Waffle iron	1120	20

Table 5: Electrical Consumption of Other Portable Appliances

(a) Portable Appliances Using Less Than 20 Kilowatt-Hours Per Year

	Average Wattage	Estimated KWH Used Yearly
Clock	2	17
Defroster-refrigerator	350	4
Floor polisher	300	15
Hair clipper	35	1
Hair dryer	379	14
Heat lamp	250	13
Heating pad	65	10
Sewing machine	75	11
Shaver	15	18
Sun lamp	280	16
Toothbrush	7	5
Vibrator	40	2

(b) Portable Appliances Using Over 20 Kilowatt-Hours Per Year

	Average Wattage	Estimated KWH Used Yearly
Blanket	180	150
Dehumidifier	200	380
Fan - attic	370	290
- circulating	90	40
- window	200	170
Germicidal lamp	20	140
Heater (radiant)	1300	175
Humidifier	120	160
Iron	1100	145
Vacuum cleaner	630	45

Design Features To Look For In Your Home

If you are in the market for a new home, or if you have plans to remodel, here are some important design features to consider:

(1) Location of the furnace should be in a central part of the house. This can reduce heating losses due to a large duct network.

(2) The thermostat should normally be located in the most-used room (unless there is zone heating). It should also be located away from drafts, cold walls, direct sunlight and heat-producing objects. It should be mounted level.

(3) A central heating and air conditioning system is more efficient than space heaters and wall units. Electric resistance heating is generally considerably more expensive than gas or oil furnace systems.

(4) Consider the advantages of the heat pump. They use about half the electrical energy normal electrical heating systems use, and they can prove to be very economical in warm climates. However, they are not very efficient in areas where the temperature regularly falls below 20° and should not be considered an instant solution.

(5) Air conditioning and heating equipment should be the smallest capacity possible to get the job done. Generally, a smaller unit running almost continuously will use less energy than a larger one running intermittently--and still cool the house sufficiently. A rule-of-thumb is that 15 to 20 BTUs per hour will cool 1 square foot of living space.

(6) The design of the heating and air-conditioning system including proper sizing, matching the duct system to the fan, proper location of outlets, etc., is the most important aspect to consider. Once the total design has been completed then efficient individual units can be considered.

(7) Choose heating and cooling units and also appliances with high "Energy Efficiency Ratios" (EER).[9] An EER of 6-7 is fair, an 8-9 is good, and a 10 or more is excellent.

(8) Even considering the inefficiencies of electrical generation[10] an electrical air conditioner is more energy efficient than a gas air-conditioner.

(9) Hot rooms, i.e., kitchen and laundry, should be located away from the southern and western sun and in a cooler area of the house.

(10) Main entrances to the house should be protected from the winter wind by means of shrubs, closed porches, walls, etc.

(11) Houses built with 2x6 studs on 24" centers, as opposed to 2x4's on 16" centers, provide more area for insulation and less wood area for heat loss. There are other approaches equally as good.

(12) Hot water heaters should be installed as close to the major users of hot water as is possible. This will help reduce heat losses from the pipes which is a function of their length. Up to 400 KWH per year can be lost from a 10 foot, 1 inch, diameter

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[9]EER is a ratio of BTU capacity to wattage rating. It will be a number ranging from 4.7 to 12. 2.

[10]Only 30% of the energy going into generation arrives at your home in the form of electricity.

copper pipe. One consideration is the placement of several smaller heaters in strategic locations throughout the house.

(13) The water heater should also be installed in a heated area since the amount of heat loss is proportional to the difference in interior and exterior temperatures. The warmer the room, the less heat loss from the water heater.

(14) As with air conditioners the smallest unit capable of providing adequate hot water is generally the most efficient unit. Also larger units are more susceptible to heat loss. On the average, a 40 gallon tank will provide ample hot water for a four-member family. "Quick-recovery" models, which provide a large burst of energy to warm the water quickly whenever the temperature gets low, should be avoided. They use up to 600 KWH more per year.

(15) Gas heaters are more economical than electric heaters in that they require less total energy.

(16) The refrigerator should be able to be located in a cool area of the kitchen, away from the range, heater, or direct sun. This will lessen its load. (This is valid for freezers also.)

(17) Electronic ignition on gas ranges reduces the gas consumption of the range by 30%.

(18) Many newer appliances, i.e., dishwashers, refrigerators, freezers, etc., have energy saving cycles or switches. These are worth considering.

(19) In general, gas clothes dryers are more efficient than electric dryers because of the poor efficiency of electrical generation,

although they do have approximately the same operating costs.

(20) A heat exchanger in the fireplace will collect unused heat for use.

(21) Rooms with more than one entrance and exit (i.e. living room, den, etc.) should have light switches at each doorway so that the lights can be conveniently turned off upon leaving.

(22) The house should have adequate attic and crawl space ventilation. Attic fans with thermostatic switches can also be useful.

We have presented a fairly substantial amount of material on conserving energy in your home. It was not our intention to burden you with too much or reduce you to apathy. We do hope that you now understand some of the reasons for the suggestions so that when and if you follow some of them, you will have a better understanding of why what you are doing will work.

In the next chapter we will move outside the home and present tips on landscaping, automobile usage, purchasing habits, etc.

CHAPTER III

ENERGY CONSERVATION OUTSIDE THE HOME

In this chapter we will consider what you can do to save money and energy in areas other than your home. Such items as exterior home planning, automobile usage, trip planning, and purchasing habits will be discussed. Some of the tips can be incorporated with little or no effort or money. Others, however, will require some investment, and still others will be useful only if you are in the market for a new home or car, or if you are considering remodeling. First, let's talk about your home.

Exterior Design Features to Consider

Several things can be done outside your home to help to save energy and money, including landscaping, home design, and orientation. Although you probably cannot do much about how your house was built or located, unless you are planning to build another one, these tips will still be useful because many of them can be applied to existing homes.

(1) The orientation of your home with respect to direction is important in controlling heat losses and gains. In general, the front of your home should face south with the principle axis (length) running east-west. This will produce a smaller heat gain than a home which is oriented north-south. Avoid having your home face the west because it will absorb all the afternoon sun in summer and much of the winter wind as well.

(2) Consideration of the climate, expecially wind and sun, in your area is important in determining the roof color and the location of windows.

(a) In warm climates light-colored roofs should be used because they reflect the sun's rays and help lower the cooling system's load. Window area should be minimal on the west walls and maximum on the north walls. This will help reduce heat gain and consequently cooling costs.

(b) In cool climates dark-colored roofing material is recommended because it absorbs the sun's heat and assists the heating system's task in winter. Window area should be a minimum on the north walls to reduce heat losses and because no solar gain is possible there.

(3) The general shape of your home will affect heat loss and gain. The less exterior wall space you have, the less heat you will lose or gain. Therefore, a square house will use less energy than a rectangular one with the same living area. Avoid L, T, and H-shaped homes since they increase perimeter distance.

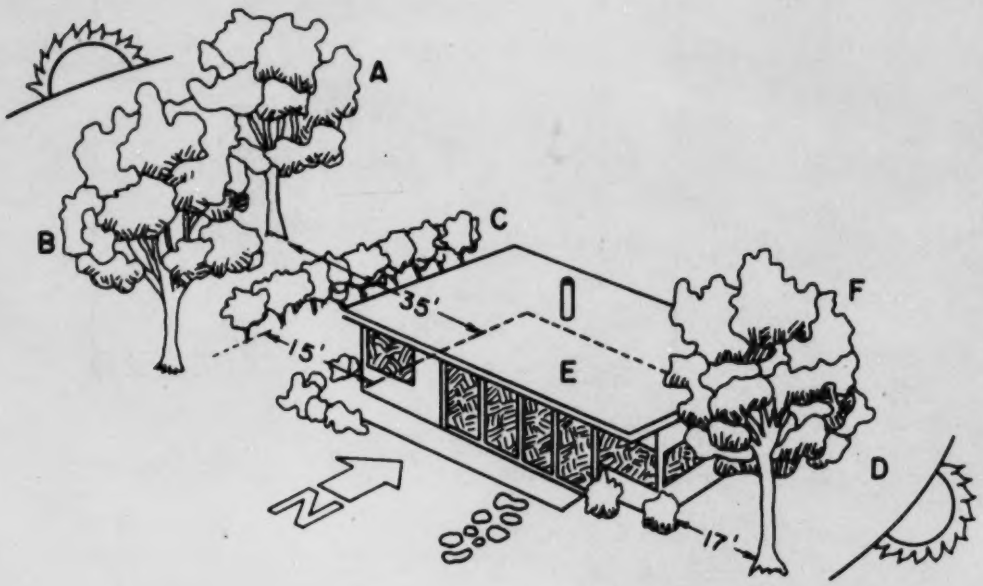
(4) One of the most effective ways to reduce your cooling system's load is to shade your home from the sun, particularly the roof and windows. Stopping the sun before it reaches the windows is seven times more effective than stopping it

with drapes or shades. Several ways in which you can do this are as follows:

(a) One of the best methods of shading your home is through the use of deciduous trees and vines. Properly positioned (i.e., approximately 15 to 20 feet from the house) on the east, and particularly the west walls, trees will shade the roof in summer but allow sun to pass through in winter. Figure 5 shows a typical example. Vines such as wisteria can be placed on southern walls so that they will grow around windows or trellises, effectively shading by absorbing and reflecting heat befor it reaches the wall. Plants will also help reduce dust and noise.

(b) Since the sun is high in the sky in the summer and low in the winter, a properly positioned roof overhang on the south wall will block the summer sun but allow the winter sun to shine in warming the house. Wooden trellises, louvered overhangs, adjustable shutters, awnings, and extended porches are also effective. Figure 6 demonstrates this principle.

(5) Do not install rock gardens next to your house because they will add to your home's heat gain. Grass and shrubs are much cooler.



A - COMPLETE SHADE COVERAGE TO THE WEST. PLACED AT GREATER DISTANCE FROM THE HOUSE, AS THE SETTING SUN LENGTHENS THE SHADOWS.

B - PROTECTS THE WEST SIDE IN EARLY AFTERNOON.

C - HEDGE CATCHES THE LAST LOW-ANGLE EVENING RAYS.

D - EARLY MORNING SUN RELIEVES COOLNESS OF THE DAYBREAK.

E - OVERHANG SHIELDS BUILDING AT NOON.

F - PROTECTION AFTER 8 A.M. IN SUMMER.

Figure 5: Typical Use of Trees to Shade a Home

(Source: State of Louisiana, Department of Conservation, Family Energy Watch Calendar 1976, Baton Rouge, Louisiana.)

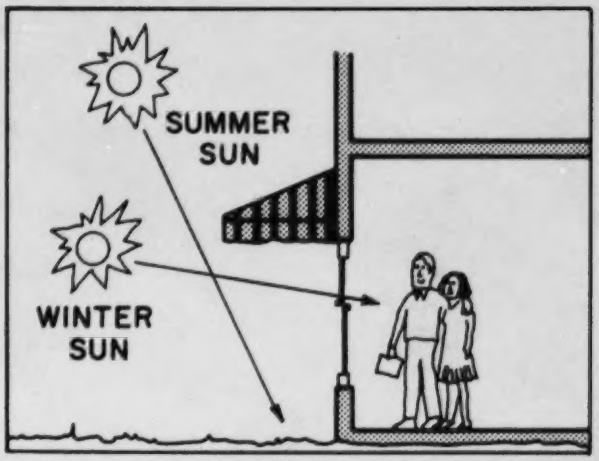


Figure 6: Properly Designed Roof Overhang

(Source: Plowman, Faye T., "Building and Remodeling to Save Energy," Energy Conservation Fact Sheet EC-32, University of Florida, 1976)

(6) Be sure windows can be opened to take advantage of natural ventilation when possible. Large west windows should be shaded and protected from the wind. Total window area should not exceed 8 to 10 percent of the floor area.

(7) Wind protection is also very important. Evergreens, shrubs, and wooden fences can all be useful as wind breaks. However, evergreens planted close to the wall are the most effective because they not only reduce the velocity, they also create a dead air space between the shrub and the wall. This space acts as insulation in the same manner as storm windows, and reduces the cooling effect of the wind. For maximum effectiveness, they should be planted close together and be rather dense.

Trees and shrubs can also be used to deflect and guide breezes to your advantage. For example, plants on the northwest

side can protect your home from prevailing winter winds and also help divert summer breezes around it as indicated in Figure 7.

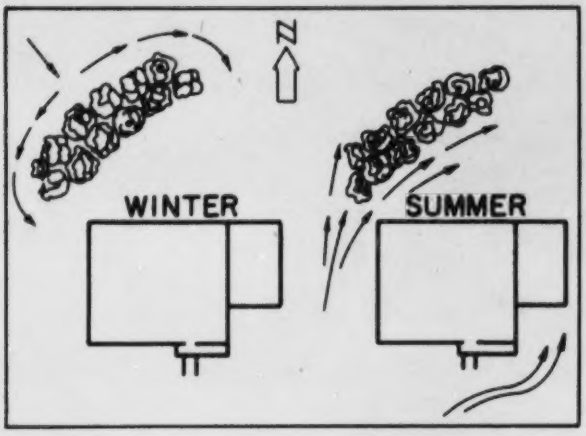


Figure 7: Position of Plants to Help Control Wind

(Source: Black, Robert, "Landscaping to Conserve Energy," Energy Conservation Fact Sheet EC-17, University of Florida, 1976)

In a high wind region, it is estimated that a tall evergreen hedge on the north side of a house can reduce the heating bill by 34% and 10% in lighter wind areas.

Automobiles

Next, let's consider your car. Since it represents approximately 40% to 45% of your yearly energy bill, any savings can prove to be substantial. And as gasoline prices continue to rise toward an estimated dollar per gallon in 1980, the more each small saving measure will mean.

The single most important element in determining your car's fuel economy is you. Driving habits are extremely important. In fact, a recent study by the Environmental Protection Agency states that

> *Driving habits and trip characteristics can have more effect on fuel economy than any vehicle design feature.*

It is estimated that careful drivers can get 30% more mileage than the average driver and 50% more than a wasteful one. Here are some tips to help make you a more careful driver.

(1) Slow down. Driving at 55 mph will give you about 20% better mileage than driving at 70 mph (i.e. 3 mpg on an average car). Dropping on down to 50 will increase your mileage by 25% (4 mpg), and 40 mph will increase mileage by approximately 50% (7 mpg). The best mileage occurs between 30 and 40 mph.

(2) Accelerate smoothly but don't creep away from stops. Get into high gear as quickly as possible. "Jack rabbit" starts require almost twice as much gas as normal ones.

(3) If possible, avoid stop and go traffic. City driving uses 30% to 50% more gas than highway driving. Drive at a smooth, steady pace, anticipating road and traffic conditions. Minimize braking by maintaining a reasonable distance and coasting to stops instead of slamming on the brakes.

(4) Climb hills gently. Hold the accelerator steady until more power is needed, then increase gradually. Avoid pressing the

accelerator to the floor. Winding and hilly roads require more gas than level straight ones.

(5) Don't allow your car to idle for more than a minute. It requires less gas to stop and restart it than to let it idle. This applies to warm-ups also. The improved viscosity of modern oils eliminate the need for long warm-ups. Instead, drive slowly for the first one-quarter mile.

(6) Join a carpool. Just pooling up with one other person could save you almost half of your current work-commuting gasoline bill.

(7) Use mass transit if possible. A large bus uses 50 percent less energy per passenger mile than a car with four passengers.

(8) Remove all excess weight from your car. Each 50 pounds costs you one percent more in gasoline costs.

(9) Avoid bad roads if possible; they increase friction and reduce mileage. In fact, driving on patched or broken asphalt roads reduces fuel economy by 14% as compared to driving on smooth roads; similarly, driving on gravel roads reduces mileage by 36% as shown in Table 6.

Table 6: MPG vs. Road Surface

If your car gets 14 MPG on good smooth roads, it will get

MPG	On	Percent Less
12	Broken asphalt	14%
11	Dirt	21%
9	Gravel	36%
6 1/2	Sand	55%

(10) Be sure to remove snow tires after the bad weather is over. They not only increase friction, but they also wear out quicker in warm weather.

(11) Check your mileage each time you fill up. This helps you learn which driving habits will produce the best mileage.

Another important factor in good fuel economy is good maintenance. Gasoline consumption increases and power decreases when your car is sick. By correcting the following, considerable amounts of gasoline can be saved.

(1) Regular tune-ups can save up to 10% of your gasoline bill. Spark plugs, timing, points, carburetor adjustment, and emission controls should all be checked. A misfiring plug can increase consumption by as much as 12% (2 mpg), and a malfunctioning carburetor can use up to 20% to 25% more gas (3 mpg). The car should be in a condition in which it can benefit from a tune-up, i.e., no burned valves or worn rings and in good mechanical condition.

(2) Keep the air filter clean. An air starved engine can waste up to one mile per gallon.

(3) Don't allow tires to become under inflated because this will increase resistance which requires more power and gasoline (up to 10% or 1 mpg more) to overcome. Check tire pressure frequently, at least once per month, and maintain it at the recommended pressure.[11]

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[11]Some suggest carrying 3 to 4 lbs. over the recommended air pressure. This will give better mileage, but it will also increase tire wear. Also there is a law which prohibits passenger cars from carrying over 36 lbs. pressure.

(4) Proper wheel alignment will help increase mileage. Misaligned tires can increase fuel usage by 0.3 mpg.

A third factor in determining mileage is the physical characteristics of the car itself. In general, the best mileage (mpg) is obtained from cars that have low weight, small engines, manual transmission, low axle ratios, and low frontal area (width x height), with low weight being the most important characteristic. Here are some items you should consider when shopping for your next car or truck.

(1) Vehicle weight greatly increases fuel consumption. A 5,000 pound car uses twice as much fuel as a 2,000 pound car. This comparison is illustrated in Figure 8.

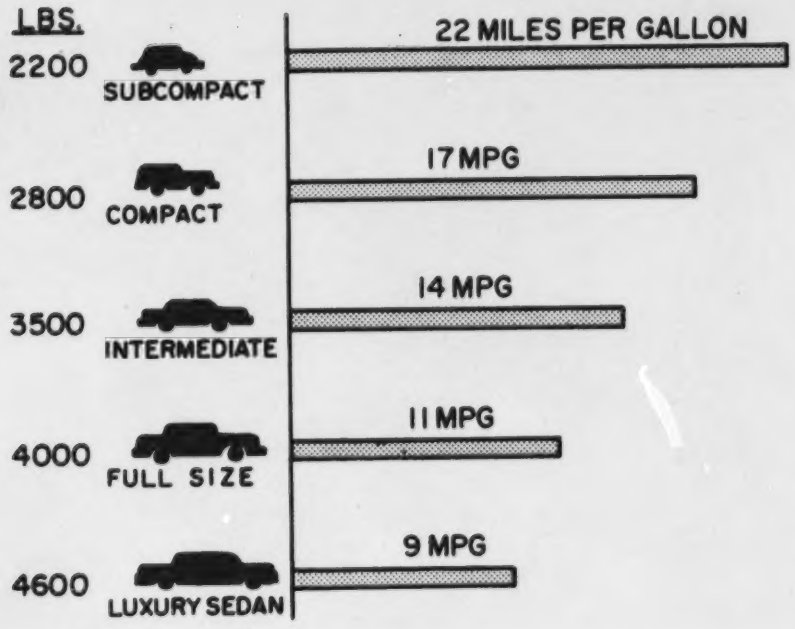

Figure 8: Comparison of Vehicle Weight to MPG

(Source: Springer, George S., and Gene E. Smith, The Energy Saving Guidebook, Technomic Pub. Co., Westport, Connecticut, 1974.)

(2) Options such as air-conditioning, automatic transmission, and power steering are noted gas users.

(a) Air-conditioning reduces fuel economy by an average of 10% (20% in stop and go traffic). Use it sparingly, especially in traffic.

(b) A manual transmission is most important on a small car where it can save 1.2 mpg as opposed to only 0.2 mpg on a regular size car.

(c) Power steering can increase fuel consumption by 1% to 6%. Power brakes and electric windows, seats, and antennas do not decrease fuel economy substantially, but they do add to vehicle weight which increases gasoline usage.

(3) Radial tires help reduce resistance and therefore help increase mileage ratings by an average of 5% to 6% (some claim 10%). They also have a longer life. These two factors will offset the additional cost if you plan to keep your car for any length of time.

(4) Currently, diesel engines get 40% to 70% better fuel economy than conventional engines. Rotary engines are 20% to 35% less efficient.

(5) Emissions controls are not the "guzzlers" some people believe. While they do increase the fuel use of 3500+ lbs. cars by 13% to 18%, cars weighing less than 3500 lbs. actually get 1% to 2% better mileage, according to recent studies by the EPA.

(6) EPA mileage ratings, which are now provided for all new cars, are the results of statistical, not actual, tests and are considered by many to be too high. They are, however, a good relative basis for comparisons between new car models.

The following is a list of several other miscellaneous tips to keep in mind when trying to save gasoline.

(1) Wind and grade have the same effect on fuel economy as does speed. Driving 50 mph into a 20 mph wind has approximately the same effect as driving 70 mph in still air. Similarly, 50 mph on a 4 percent grade is the equivalent of 70 mph on a level grade.

(2) By filling your tank yourself at self-service pumps, you can save about 2 cents per gallon. Don't neglect to check your oil though!

(3) Be wary of additives and gadgets which claim to increase mileage.

(4) Consider a vacuum guage ($8 to $16). It measures how efficiently an engine is running and when fuel consumption increases. It can help you monitor your driving techniques to learn which ones produce the best mileage, and it can also help detect engine problems.

(5) Never attempt to save gas by shutting off your engine and coasting down hills.

(6) Pulling a trailer adds considerably to wind resistance and weight. It takes more power to overcome this extra load; consequently, even slower speeds are necessary to provide adequate mileage.

(7) A 10-horsepower motorcycle gets about 80 to 100 mpg. Of course, they don't protect you from the elements, and they are less safe statistically than automobiles.

(8) Use gasoline of the correct octane rating for your car. The "correct" one is the lowest possible octane level which will keep your car from "knocking."

A very effective method of saving gas is to park your car and not go anywhere. While this would save 100 percent of your gasoline costs, it may not be very practical. What you can do, however, is essentially the same thing, i.e., minimize mileage via efficient trip planning. Some ways of doing this are:

(1) Eliminate all unnecessary trips and combine others so that as much as possible can be accomplished in one outing. Cold engines are very inefficient, so it is important to fuel economy to get the engine warm and keep it that way. In an average car, ten 40-mile trips will use the same amount of fuel as 100 one-mile trips. If singular short trips cannot be avoided, walk or ride a bicycle to avoid using the car. Trips of less than five miles account for 15% of the total miles driven in the United States and 30% of the fuel used.

(2) If you have several errands to run, plan your route so as to minimize mileage and time. Avoid backtracking if possible.

(3) Call in as many orders as you can to avoid making a short trip. Many places will deliver. Bank or pay bills by mail.

(4) Plan your vacation route carefully. Try to avoid bad roads and large cities during rush hour traffic (i.e., 5-6 p.m., 7-8 a.m.). Consider traveling by train or bus instead of by car or plane. Also consider vacationing closer to home; many people never consider visiting a nearby tourist attraction that outsiders travel many miles to see. Take only what is essential and avoid having to use a luggage rack which can waste 1 to 2 mpg. If it cannot be avoided, drive slower.

(5) Cold weather affects gas mileage. It takes 10% less gas at 80° F. than at 30° F. (2% less for each 10° F. increase). It would profit you then to make long trips in the summer months.

(6) Short trips are greatly affected by cold weather. In 10° F. weather, the average car only gets 4 mpg for the first mile, while in the summer it would get 6 mpg for that initial mile. This is another good reason to curtail short trips, especially in winter.

Workshop, Yard, and Garden

A few items should be mentioned in this area.

(1) Keep electric tools in top shape. Keeping the cutting edges sharp will reduce cutting time and consequently energy usage.

(2) When buying new tools, choose ones with the minimum horsepower adequate for the intended job, preferably your own.

(3) When using gasoline powered equipment, don't allow it to idle for any length of time. The same argument that applies to cars applies here.

(4) Of course, shut off all tools and equipment when not in use.

Purchasing Habits

Changing your purchasing habits so that you consider not only the initial cost of the item but its operating (energy) cost and life span as well will not save you large sums of money at first, but it will provide long-run savings for you and the country. In fact, the most energy efficient item may be the most costly initially; however, if operating costs over the life of the product are considered, it will probably prove less expensive in the long run. This advice applies to automobiles, appliances, pumps, fans, compressors, etc.

Other hints which can prove useful are:

(1) Purchase items made from recycled materials or which can be recycled (i.e., steel, aluminum, paper, and glass). Recycling steel requires only 25% of the original energy needed; recycling aluminum only requires 5% of the enrgy initially needed. The factor for paper is 33%. Purchasing such items allows manufacturing companies to use less energy in production which helps us all in the long run.

(2) Purchase durable, long-life goods. Less replacement means less energy required to manufacture.

(3) No-iron fabrics and garments will not only save energy via less iron usage, but will also save you time.

(4) Always compare energy efficiencies of products. Consider items with energy-saving features even though they may add to the cost. Some examples are switches to cut off the heaters in frost-free refrigerators and energy saving drying cycles on dishwashers. The energy required to manufacture some products far exceeds the energy consumed by that product during its lifetime. These items are not very energy efficient. Some examples are:

Item	Ratio: Energy to Manufacture/ Energy Used in a Year
Carving Knife	20
Can Opener	17
Garage Door Opener	50
Garbage Disposal	30
Power Mower	3
Roto-Tiller	25
Shredder	20
Snow Blower	25
Trash Compactor	20

Source: Smith, Thomas W., and John Jenkins, The Household Energy Game, University of Wisconsin, 1974.

This chapter has attempted to briefly cover a variety of areas outside of the home for which energy/money savings can be achieved. There are no doubt many more, and we hope that what has been presented here will cause you to think about your own home and particular areas where you can save. To assist you in starting your search for areas in and around your home in which you can achieve savings, we have

developed an energy checklist for your use. This checklist is presented in Appendix B and contains many of the major areas of concern discussed in Chapters 2 and 3.

In the final chapter we will consider the future. The discussion will cover energy sources which are currently being researched and the forecasts for energy in the next 25 to 50 years.

CHAPTER IV

ENERGY SOURCES OF THE FUTURE

As mentioned in the first chapter, we in the United States now depend on petroleum and natural gas to meet approximately 75% of our energy needs with coal, hydroelectric, and nuclear power providing the remainder. However, petroleum, natural gas, and coal are all classified as nonrenewable sources of energy. The probability of their remaining the number one energy sources in the future is extremely low. Consequently, other new sources of energy will have to be developed and older sources will have to be utilized more efficiently in order to take the strain off the rapidly diminishing supplies of petroleum products. In this chapter, it is our purpose to briefly describe some of the major sources of energy which are being researched for possible future use. Almost all are technologically feasible now; the holdback for many, however, is economics. They are simply not competitive with existing sources of energy based on current prices; in particular, the current price of $12 to $15 per barrel for oil. However, more research and higher energy prices will make them feasible energy sources in the future.

Coal

Coal is the most abundant of all our fossil fuels. Even though classified as a nonrenewable source, experts claim that the United States has enough coal for at least the next 200 years (some even claim 700 years). That represents more energy than is contained in the oil of all the Middle East countries combined. In the first quarter of this century

75% of our energy came from coal; at the present time the figure is 18%. Barriers to be overcome before coal can become an energy leader tend to be environmental and safety related. Strict safety laws limit deep mining, environmental considerations inhibit strip mining, and pollution restrictions pose problems in burning coal for electrical generation. However, these problems are being solved, and coal will play a significant role in our energy future. This is especially true for the immediate future which represents a transition period.

Nuclear Power (Fission)

Nuclear power plants generate electricity in much the same way as do oil, gas, or coal burning plants. The difference is the way in which they produce the heat which creates the steam to run the electrical generators. Instead of burning a fossil fuel, nuclear plants rely on the heat produced when the nucleus of uranium 235 atoms are split (i.e., fissioned) in a nuclear reactor. Resulting chain reactions produce the necessary heat in a very clean process. One problem, however, is that uranium 235 and other fissionable material, as is the case with petroleum, are in short supply. The present estimate is a 40 year supply. However, breeder reactors can solve this problem because of their ability to create more fissionable fuel than they consume, and by the fact that they can use the by-products of conventional reactors (e.g., plutonium). At the present time there are 61 conventional nuclear power plants in operation in the United States. There are no breeder reactors in the United States although a prototype model under construction on the Clinch River near Oak Ridge, Tennessee, will be ready by 1983. Russia and France do have breeder reactors in use at the present time.

There has been considerable opposition to nuclear power centered particularly on safety, waste disposal and cost. However, the present estimate of the risk of a fatality in a nuclear accident from 100 nuclear plants is 1 in 5,000,000,000 as compare to 1 in 4,000 from a car accident or 1 in 100,000 from air accidents. The initial cost of nuclear plants is higher than for conventional oil, gas or coal burning plants; but the operating costs over the life of the plant are substantially less. Several methods for disposal of wastes have been developed, but a permanent disposal plan has not been finalized as yet.

Present estimates are that nuclear power can supply 22% to 23% of our energy needs by the year 2000. Nuclear power, therefore, is not the complete solution to the energy gap, but it appears to be a good short term partial solution until more energy development can take place.

Geothermal

Geothermal energy is the energy which comes from the heat inside the earth. There are three basic sources of this heat: natural steam, hot water, and hot dry rock. The major use of geothermal steam has been in electrical generation, while the hot water has been used for heating purposes in a few locations. Dry rock is the largest source of heat; but, methods of tapping it are only in the research stage, as yet.

Presently the only commercial geothermal power plant in the United States is located north of San Francisco in a steam field known as The Geysers. However, experts do predict that 1% to 3% of our energy can possibly be derived from this source by 2000.

Solar Power

We receive an enormous amount of energy from the sun. Enough falls on just 0.5% of the land area of the United States to supply the total needs of the country, projected to the year 2000. The primary application of solar energy to date has been in heating and cooling buildings, with approximately 200 solar heated houses in existence today. While not currently competitive with gas or oil furnaces in most parts of the country, it is predicted that solar systems will be commercially available at competitive prices by 1980. Some states have even provided tax write-offs for those who purchase solar systems.

Other uses of solar energy are to heat water in much the same manner as space heating. These systems are presently in use in the United States as well as other countries. Production of electricity is another use of the energy from the sun. This can be done either by first converting to thermal power and then to electric power or by direct conversion via photovoltaic cells. With the latter method, one concept under consideration is to use satellites above the earth to gather solar energy which would then be transmitted to earth via microwaves where it would be reconverted to electricity.

One of the major problems with solar power is storage. Many techniques are being developed, but at present solar power is normally considered as an auxiliary system with a conventional system for back-up during extended periods of cloudy days. ERDA officials estimate that 25% of our energy needs could be supplied by solar power by 2020.

Wind Power

Wind will likely be used primarily for electrical generation. The greatest problem is that the supply is not constant, requiring energy storage.

Some areas of the country are better suited to employing wind power than others. The fact that wind and solar power peak at different times suggests that combination solar-wind systems could likely provide a significant solution to the energy problem.

The first commercial wind station will be available by the early 1980's. Work is also underway in the development of off-shore wind systems. Not only would they be used for electrical conversion; but, during periods of excess wind, they could be used to distill pure water and generate hydrogen gas, via electrolysis, to be stored and later used in fuel cells for electrical conversion.

Bioconversion

Bioconversion is the process of converting natural materials into more useful forms of energy (e.g., hydrogen, methane, alcohol, etc). Work is underway in the development of oil shale and tar sands which are materials which contain possibly useful fuel if it can be removed economically. Developing alcohol derivatives from wastes also appears quite promising, as the product can be used in a mixture with gasoline. Refuse conversion is an excellent source of heat. For example, one pound of dry refuse contains 11,000 BTUs whereas one pound of coal contains 25,500 BTUs.

Ocean Thermal Power

Ocean thermal power is a process in which the difference in temperature between the upper and lower levels of water in the ocean can be used to produce electricity. A working fluid, such as propane, would pass through the warm, upper level, boil, and produce vapor which would turn a turbine and drive a generator. As the vapor travels through the colder, lower level of water, it would condense and the process would begin again.

It is estimated that commercial, competitive ocean thermal power systems will likely be installed in less time than breeder reactors. They would also provide cheap energy because no fuel is consumed in the process.

Belt-Tightening

This process involves you! All the potential sources of energy mentioned above are technologically feasible and more than likely will come into existence in our lifetime. However, they all require much more research and study before becoming a reality. Once they are set in motion they will still require years to develop and construct on a commercially acceptable basis. Therefore, the short-term solution which will help not only your pocketbook but the energy shortage as well is to "tighten our belts." We must learn to live, not less comfortably, but more conservatively. There is no good reason for wasting anything, least of all precious energy. By watching ourselves a little closer and wasting less, we can save substantial amounts of money for ourselves and energy for the country--without sacrificing comfort!

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APPENDIX A

Estimated Dollar Savings

APPENDIX A

The purpose of this appendix is to present dollar savings for some of the techniques and tips presented in Chapters 2 and 3. As mentioned earlier, your actual savings may be higher or lower depending on your particular situation. Figures here are based on "national averages" for energy consumption. The majority of the savings are based on the cost figures given below.

Energy	Savings Based on a Cost of
Electricity	$.03/KWH
Natural Gas	.12/therm (100 Cu. Ft.)
Hot Water	.005/gallon (From 40°F. to 140°F.)
Gasoline	.60/gallon

Some of these costs are below the national averages, but are fairly representative of this area. All savings are presented on a yearly basis.

CHAPTER II SAVINGS

Measure Taken	Approximate Annual Savings
Increase Ceiling Insulation from	
R-3 (≈ 1 in.) to R-19 (≈ 6 in.)	$120-150
R-7 (≈ 2 in.) to R-19 (≈ 6 in.)	50-60
None to R-19 (≈ 6 in.)	140-170
Increase Wall Insulation from	
R-7 (≈ 2 in.) to R-11 (≈ 3 in.)	20-25
Caulk and Windowstrip Windows and Doors	40-50
Install Storm Windows and Storm Doors	50-75
Lower Thermostat to 68° in Winter (from 76°)	35-45
Install Clock Thermostat or Consistently Reduce Night Temperature by 5°	25-35
Tune up Any Furnace in Bad Shape	20-25
Proper Use of Drapes (Insulated) and Carpets	10-20
Raise Thermostat to 78° in Summer (from 72°)	25-35
Fix Leaky Hot Water Faucet	10-25
Install Insulation Around Hot Water Tank	
One Inch	6
Four Inches	12
Install Insulation Around Open Pipes (25 Ft. Length)	
One Inch	12-20
Decrease Water Temperature from 160° to 140°	5-8
Decrease Hot Water Usage by 10 Gal/Day/Member for a Family of Four	70
Install Flow Restrictors on Shower Heads and Faucets (1/2 Original Flow)	10
Cut Dishwasher Usage from Twice to Once/Day	10
Air-Dry Dishes in Dishwasher	5-6

Measure Taken	Approximate Annual Savings
Keep Freezer Over 1/2 Full	$ 5
Close Doors Quickly on Refrigerator and Freezers; Decide on What You want Before Opening	10
Eliminate Spare Refrigerator	30
Replace 1/2 of Lighting With Fluorescent	10
Wash Clothes Entirely in Cold Water	10-12
Dry Clothes on Line	
Warm Weather Only	12-15
All Year	30
Use Exterior On-Off Switch on Instant-On TV	5
Reflective Coating on Windows	15-20
Install Heat Pump	150-180
Eliminate Constant Burning Gas Light (24 Hr.)	20-25

CHAPTER III SAVINGS

Measure Taken	Approximate Annual Savings
Install Awnings or Shade Trees on the East and West Sides of Your House	$ 15-18
Tall Evergreen Hedge to Block North Wind	15-20
Drive at 55 MPH Instead of 70 MPH*	
If You Normally Get 10 MPG You Can Expect to Save	60
12 MPG	50
15 MPG	40
20 MPG	30
30 MPG	20
Improve Driving Techniques	50-70
Start a 3-Person Car-Pool to Work	90-110
2-Person Car-Pool to Work	70-80
Take a Bus to Work	120-140
Walk or Ride a Bicycle to Work	175-200
Reduce Mileage 15 Mile/Week (750/Year)	30
Reduce Local Trips ($\leq$ 10 Miles) by 5%	10-12
Regular Tune-Up	25-50
Proper Wheel Alignment	10
Radials	20-25

*Based on 6,000 miles per year driven on interstate or 55 mph speed limit roads.

MISCELLANEOUS FACTS

100 watt bulb left on every night costs 350 KWH = $10-11/yr.

Manual defrost uses 500-700 KWH less/yr. = $15-21

Color TV on 6 hrs. every day = 700 KWH/yr. = $21
Avg. 4 hrs. every day = 500 KWH/yr. = $15

Quick recovery hot water heater costs 600 KWH more per year = $18

Electronic ignition on furnace saves $10/yr.
Electronic ignition on gas ranges saves 100 therms/yr. = $12

Energy-efficient refrigerators saves up to $30 over regular model

Solid state TV vs. tube type saves $5-10

Based on 12,000 mi/yr and $.60/gal.

If the avg. MPG of your car is	Your yearly gasoline cost will be
10	$720
12	600
15	480
18	400
20	360
22	327
25	288
28	257
30	240
35	206
40	180

APPENDIX B

Checklist of Energy Saving Suggestions

Page Reference	Suggestion	Check If You Should Do
7	1. Insulation in your attic.	____
7	2. Insulation in walls and floors.	____
8	3. Other insulation suggestions.	____
10	4. Skirting for mobile homes.	____
11	5. Caulk around door and window frames.	____
11	6. Re-putty loose window panes.	____
11	7. Caulk around air conditioners.	____
11	8. Weatherstrip door and window edges.	____
11	9. Install storm windows or plastic.	____
12	10. Install storm doors.	____
12	11. Adjust thermostats for winter.	____
13	12. Install a clock thermostat.	____
13	13. Humidify the air in winter.	____
13	14. Wear warm clothing in winter.	____
13	15. Tune-up your furnace.	____
13	16. Have pilot adjusted in furnace.	____
13	17. Clean your furnace.	____
14	18. Change heater air filters.	____
14	19. Repair leaks in heater ducts.	____
14	20. Keep radiator and registers clean.	____
14	21. Don't obstruct radiators or registers.	____
14	22. Reflect radiator heat.	____
14	23. Close off unused rooms and close radiators or registers.	____
14	24. Close door crack in closed rooms.	____
14	25. Avoid using portable heaters.	____
14	26. Wisely use curtains and shades.	____
14	27. Insulate or line drapes.	____
15	28. Prevent air movement behind drapes.	____
15	29. Ventilate attic in winter to limit moisture buildup.	____
15	30. Adjust thermostat for summer.	____
15	31. Lower humidity in summer.	____
15	32. Don't use laundry or wash dishes at hot part of the day in summer.	____
15	33. On very hot days use high fan speed.	____
16	34. On cooler days use natural ventilation and don't use air conditioner.	____
16	35. Wear light clothing in summer.	____
16	36. Replace air conditioner filters as needed.	____
16	37. Minimize use of lights and appliances in summer because of heat they produce.	____
16	38. As practicable cook during early and late hours in summer.	____
16	39. Turn off furnace pilot light in summer.	____
16	40. Install attic fan and use in summer if attic is not properly insulated.	____

Page Reference	Suggestion	Check If You Should Do
16	41. Eliminate cooling duct leaks.	____
17	42. Shade your air conditioning unit.	____
17	43. Do not restrict air flow to an air conditioner.	____
17	44. Clean the air conditioner condenser coil.	____
17	45. Retain air conditioning by opening doors as little as possible.	____
18	46. Repair all hot water leaks.	____
18	47. Insulate hot water heater.	____
18	48. Insulate hot water pipes.	____
19	49. Lower hot water temperature as much as is practicable.	____
19	50. When gone from home, lower not water temperature.	____
19	51. Cut down on the use of hot water in your family.	____
19	52. Don't allow hot water to run, unused.	____
19	53. Remove sediment from your hot water tank.	____
19	54. Take showers rather than baths.	____
19	55. Install flow restricters.	____
20	56. Use the kitchen exhaust fan when cooking in summer.	____
20	57. On very hot days, plan a no-cook meal or eat out.	____
20	58. Do a lot of cooking in the oven when using the oven.	____
20	59. Oven cleans easiest soon after it is used.	____
21	60. Use pressure cookers.	____
21	61. Cover pots and pans when possible	____
21	62. Complete defrost frozen foods before cooking.	____
21	63. Use as little water as necessary for boiling.	____
21	64. If water is to be boiled, start with hot tap water.	____
21	65. Preheat less than 10 minutes when possible.	____
21	66. Use retained heat in ovens.	____
21	67. Avoid opening oven door.	____
21	68. Clean stove eye reflector.	____
22	69. Use pans that are as large or larger than electric stove elements.	____
22	70. Do not allow the flame on gas stoves to go beyond the pan edge.	____
22	71. Use smaller appliance when possible rather than range.	____
22	72. Have the range pilot light properly adjusted.	____

Page Reference	Suggestion	Check If You Should Do
22	73. Do not use the oven to space heat.	____
22	74. Microwave ovens are more efficient than conventional ovens.	____
22	75. Don't let the hot water run continuously while you wash dishes.	____
22	76. Use a dishwasher as few times as possible.	____
23	77. Scrap dishes before putting them in the dishwasher.	____
23	78. Let washed dishes air dry in the winter.	____
23	79. Turn off defrost heater in your refrigerator when humidity is low.	____
23	80. Check for refrigerator door leakage.	____
23	81. Set proper temperature in your refrigerator.	____
24	82. When away from house, raise the temperature in your refrigerator.	____
24	83. Cover food before putting in refrigerator.	____
24	84. Keep refrigerator and freezer full.	____
24	85. Open the door on your refrigerator and freezer as little as possible.	____
24	86. Load your freezer gradually.	____
24	87. Keep your refrigerator and freezer condenser clean.	____
24	88. Allow air circulation near your refrigerator or freezer condenser.	____
25	89. Use a smaller number of larger wattage bulbs when possible.	____
25	90. Use lower wattage bulbs when possible.	____
25	91. Long life incandescent bulbs are less efficient.	____
25	92. Flourescent lighting is more efficient than incandescent.	____
26	93. Always turn off incandescents when not in use.	____
26	94. Install light dimmers.	____
26	95. Light colored rooms and furniture require less light.	____
26	96. Clean lamps and light fixtures.	____
26	97. Use outdoor lights only when needed.	____
26	98. Turn off lights when not in use.	____
27	99. Use a lower temperature water in washer if possible.	____
27	100. Try to wash full loads.	____
27	101. Sort clothes and wash as needed by category.	____
27	102. Air dry clothes.	____
27	103. Remove clothes from a dryer promptly.	____
28	104. Check the door seal on your dryer.	____
28	105. Run consecutive loads through your dryer.	____

Page Reference		Suggestion	Check If You Should Do
28	106.	Sort according to drying needs.	____
28	107.	Dry full loads.	____
28	108.	Keep the dryer lint screen clean.	____
28	109.	Properly vent your dryer.	____
28	110.	Close off the room when using a fireplace.	____
28	111.	Purchase a glass firescreen.	____
29	112.	Close the damper when the fireplace is not in use.	____
29	113.	Cut back in the use of appliances.	____
29	114.	Use appliances during non-peak use hours.	____
30	115.	Iron in batches.	____
30	116.	Use a clean bag in your vacuum.	____
30	117.	Shut off a spare refrigerator when not in use.	____
30	118.	Solid state TVs use less energy.	____
30	119.	Instant-on TVs waste energy.	____
30	120.	Teach children to close doors quickly.	____
34	121.	Furnace should be centrally located.	____
34	122.	The thermostat should be in the most used room.	____
34	123.	Central heating is more efficient than individual units.	____
34	124.	Electric heating is usually more inefficient than gas or oil furnace systems.	____
34	125.	Heat pumps are especially efficient in moderate zones.	____
34	126.	Select a heating or air conditioning unit of the capacity needed, not more.	____
35	127.	Purchase a well balanced heating or air conditioning system.	____
35	128.	Purchase high EER equipment.	____
35	129.	Electrical air conditioning is more efficient than gas air conditioning.	____
35	130.	Hot rooms should not be located on southern or western sides of a house.	____
35	131.	Protect main entrances to the house.	____
35	132.	Space house studs on 24" centers when building a house.	____
35	133.	Locate hot water heaters as close as possible to their greatest use.	____
36	134.	Install a water heater in a heated area.	____
36	135.	Install as small a water heater as possible.	____
36	136.	Gas heaters are more economical than electric heaters.	____
36	137.	Do not put a refrigerator or freezer close to a stove or oven, or in a sunny location.	____
36	138.	Electronic ignition on gas ranges reduce total gas consumption.	____

Page Reference	Suggestion	Check If You Should Do
36	139. Purchase energy saving switch appliances.	____
37	140. Install room light switches at all exits to the room.	____
37	141. Install a heat exchanger in your fireplace.	____
38	142. The front of a house should face south, if possible.	____
38	143. The longest length of your house should run east-west.	____
39	144. In warm climate use a light colored roof.	____
39	145. In warm climates windows on the west side should be of minimal size.	____
39	146. In cool climates dark roofs should be used.	____
39	147. In cool climates, window area should be minimum on the north side.	____
39	148. A square house is most energy efficient.	____
39	149. Shade your home.	____
40	150. Shade with deciduous trees.	____
40	151. Use vines on south walls.	____
40	152. Roof should overhang on south side.	____
40	153. Keep rock gardens away from house.	____
42	154. Use natural ventilation.	____
42	155. Shade west windows from wind.	____
42	156. Provide wind protection.	____
44	157. Drive slower.	____
44	158. Accelerate smoothly.	____
44	159. Minimize braking.	____
44	160. Climb hills gently.	____
45	161. Don't idle car for more than a minute.	____
45	162. Join a carpool.	____
45	163. Use mass transit.	____
45	164. Remove excess weight from your car.	____
45	165. Avoid bad roads.	____
46	166. Do not use snow tires when not needed.	____
46	167. Tune your car regularly.	____
46	168. Keep air cleaner clean.	____
46	169. Keep tires properly inflated.	____
47	170. Be sure tires are properly aligned.	____
47	171. Use a low weight, low horsepower, manual transmission car.	____
48	172. Power steering and car air conditioners use energy.	____
48	173. Use radial tires.	____
48	174. Use diesel engines when possible.	____
49	175. Check efficiency of your engine with a vacuum gauge.	____
49	176. Use even lower speeds when pulling a trailer.	____

Page Reference		Suggestion	Check If You Should Do
50	177.	Use the correct octane rating gas in your car.	____
50	178.	Don't use your car when you don't need to.	____
50	179.	Combine small trips into one trip.	____
51	180.	Use telephone instead of car when possible.	____
51	181.	Plan trips.	____
51	182.	Long trips in summer are cheaper than in winter.	____
51	183.	Avoid short trips in winter.	____
51	184.	Keep electric tools in good shape.	____
51	185.	Keep cutting tools sharp.	____
52	186.	Use minimum horsepower tools.	____
52	187.	Do not idle gasoline powered equipment.	____
52	188.	Shut off equipment when not in use.	____
52	189.	Purchase energy efficient equipment.	____
52	190.	Purchase recycled materials.	____
53	191.	Purchase long-life goods.	____
53	192.	Purchase no-iron fabrics.	____